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John S. Mamoun D.M.D.
Private practice in Manalapan, NJ

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Restoration of Dental Implants with Screw-Retained Crowns

Optimizing Contact Area Geometry to Prevent Food Impaction

John Mamoun, D.M.D.

ABSTRACT

A single-unit, screw-retained fixed partial denture or crown, made for a dental implant, may show food impaction between the screw-retained crown and an inter-proximal tooth surface. This restorative error may be due to an open contact or a large interproximal embrasure space volume between the screw-retained prosthesis and an interproximal tooth surface. Food impaction may also occur due to the contact plane of the restoration being parallel with the contact plane of the neighboring tooth instead of a more correct contact plane geometry where both interproximal contact planes converge slightly towards each other to form a "triangular" embrasure space. These errors of contact plane geometry for a screw-retained restoration may be due to the screw-retained restoration not having an optimal path of placement to follow for insertion into the implant.

This article defines the path of placement and the optimal contact area geometry of a screw-retained implant crown restoration and describes how a dentist can contour interproximal tooth surfaces to facilitate an optimal path of placement for the screw-retained crown that will be made for a dental implant, to allow a dental laboratory technician to fabricate a fixed partial denture with an optimal contact area geometry. The article also shows how microscope-level magnification and coaxial illumination facilitate visualizing and optimizing the path of insertion for a screw-retained crown.

The path of placement of a fixed partial denture is a set of imaginary parallel axes, such that every atom (or mass element) of the fixed partial denture travels along an axis that is parallel to this set of imaginary axes, while the fixed partial denture is being seated onto its abutment. To prevent food impaction around a fixed partial denture made for an abutment, the plane of the interproximal surface of each tooth that neighbors the fixed partial denture should converge slightly towards the set of imaginary parallel axes that form the path of placement of the fixed partial denture. This slight convergence of the neighboring tooth interproximal surface to the axes of the fixed partial denture path of placement

permits fabricating a fixed partial denture that follows a specific path of placement, such that the resulting prosthesis will have interproximal contact planes with a tiny angle of convergence with neighboring interproximal tooth surfaces and minimal embrasure space volume between the prosthesis and the neighboring teeth. This may result in minimal or no food impaction at the interproximal contact areas.[1,2]

There are minimal evidence-based criteria that define what constitutes an ideal interproximal contact plane geometry that will minimize food impaction between a fixed partial denture and a neighboring tooth.[3-15] The author suggests that an optimal contact area geometry has three components. First, the interproximal surfaces of the fixed partial denture and a neighboring tooth should slightly converge towards one another. Second, the embrasure space volume between the two surfaces should be minimal. Third, the contact between the two interproximal surfaces should consist of a contact area, instead of a contact line consisting of the occlusal-interproximal line angle.

The cylinder-shaped intaglio surface and volume of an implant will rigidly define the path of placement of a screw-retained fixed partial denture that will be made for that implant. The circular perimeter, and the relatively cylindrical three-dimensional shape of an implant intaglio volume, form the dimensions of an imaginary cylinder. The set of imaginary parallel axes that form this imaginary implant intaglio cylinder forms the set of imaginary parallel axes of the path of placement of the future screw-retained prosthesis made for this implant.

For a laboratory technician to be able to fabricate a screw-retained restoration for an implant that features an optimal contact area geometry, the interproximal surface of each tooth neighboring the future screw-retained prosthesis should converge slightly towards the set of imaginary parallel axes that form the cylindrical path of placement of the future screw-retained prosthesis. This slight convergence allows the laboratory technician to fabricate a screw-retained prosthesis that can follow the path of placement defined by the cylindrical shape of the implant intaglio surface and that also has interproximal surfaces that can slightly converge towards the interproximal surfaces of the neighboring teeth (Figure 1).

This slight convergence of interproximal surfaces between the screw-retained prosthesis interproximal surface and a neighboring tooth interproximal surface will result in a screw-retained prosthesis with minimal embrasure space volume between the prosthesis and a neighboring tooth at a specific interproximal contact area. The less volume the embrasure space has, the less food that hypothetically might impact into the embrasure space (Figure 2).

If the plane of a neighboring tooth interproximal surface is slightly divergent relative to the set of imaginary axes that form the path of placement of the screw-retained restoration, then the laboratory technician will be forced to fabricate a screw-retained prosthesis such that the contact

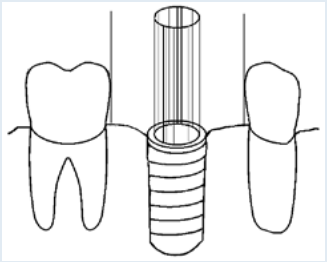


Figure 1. Diagram shows optimal interproximal contact plane geometry, where neighboring teeth interproximal contact planes converge by tiny angle towards set of imaginary parallel axes that form imaginary cylinder-shaped path of placement determined by cylinder-shaped intaglio volume of implant.

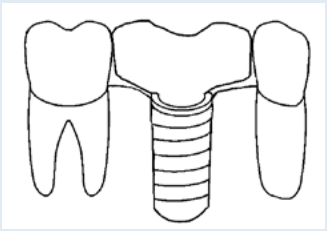


Figure 2. Diagram shows screw-retained crown placed with optimal interproximal contacts, resulting in small interproximal volume space with both neighboring teeth, thanks to slightly convergent interproximal surfaces of neighboring teeth.

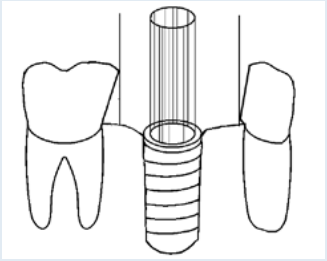


Figure 3. Diagram shows two examples of nonoptimal interproximal contact plane geometries. Neighboring molar interproximal surface converges at wide angle towards set of imaginary parallel axes that form imaginary cylinder-shaped path of placement that is determined by cylinder-shaped intaglio volume of implant. Neighboring premolar interproximal surface diverges from path of placement axes.

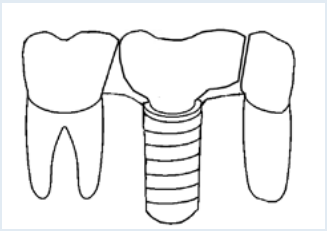


Figure 4. Diagram shows screw-retained crown placed with nonoptimal interproximal contacts, resulting in "teepee" contact with large interproximal volume space with neighboring molar, and a noncontacting interproximal crown surface that is parallel with, but not contacting, divergent premolar interproximal surface.

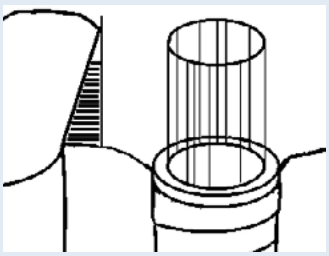


Figure 5. Imaginary plane shown parallel with axes that form path of placement of future screw-retained crown and also intersects occlusal-interproximal line angle of tooth neighboring implant. Linear bars at each vertical height point along neighboring tooth interproximal surface show distance between interproximal surface and imaginary plane at different vertical height points. Laboratory technician cannot shape crown interproximal surface material to be closer to tooth interproximal surface than distance between imaginary plane and interproximal surface at various vertical height points.

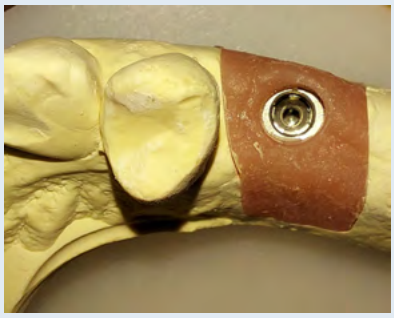


Figure 6. Model shows optimal, interproximal contact plane on premolar neighboring implant. Only superior line angle of interproximal surface is visible when implant is viewed such that entire intaglio surface volume of implant is visible, which corresponds with viewing axis parallel with set of imaginary parallel axes that form cylinder-shaped path of placement of implant.

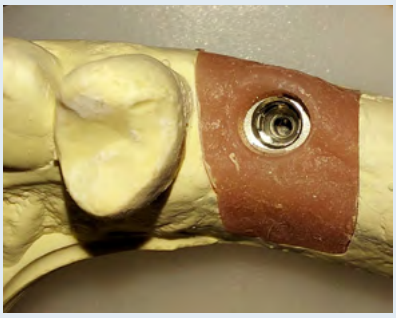


Figure 7. Same implant in Figure 6, now viewed with viewing axis that is shifted by tiny angle, such that viewing axis is slightly nonparallel with axes of path of placement. Slight reduction of visibility of implant intaglio surface proves viewing angle is only slightly off parallel with axes of the path of placement formed by the implant intaglio volume. Inferior line angle of interproximal contact is barely visible in this slightly off-parallel viewing axis, which proves interproximal surface has optimal, tiny tilt angle slightly convergent towards path of placement axes.

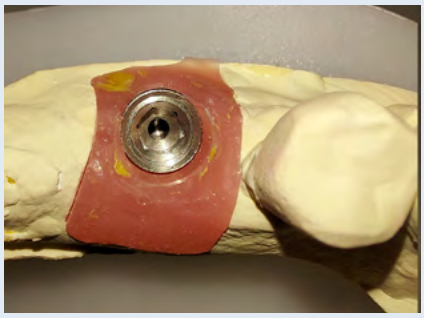


Figure 8. Model shows nonoptimal, divergent, interproximal contact plane on premolar neighboring implant. Both superior and inferior line angles of interproximal surface are visible when implant is viewed such that entire intaglio surface volume of implant is visible, which corresponds with viewing axis parallel with set of imaginary parallel axes that form the cylinder-shaped path of placement of implant.

plane of the prosthesis is parallel with the contact plane of that divergent interproximal tooth surface and the parallel interproximal surfaces cannot contact each other. A divergent tooth interproximal surface is one where the superior aspect of the interproximal surface is more distal from the implant compared to the inferior aspect of that interproximal surface (Figure 3).

If the plane of a neighboring tooth interproximal surface converges at a large angle (Figure 3) towards the set of imaginary parallel axes that form the cylindrical path of placement of the future screw-retained prosthesis, the laboratory technician will be forced to design a screw-retained prosthesis with a large embrasure space volume at that interproximal contact (Figure 4).

Embrasure Space Geometry

An imaginary plane can be envisioned that is parallel to the axes that form the path of placement of the future screw-retained crown. This plane can be visualized as intersecting the occlusal-interproximal line angle of a tooth neighboring the future screw-retained crown. The interproximal surface of that neighboring tooth, and the imaginary plane, form an imaginary three-dimensional triangle. The volume of this imaginary triangle will be the maximum volume of the interproximal embrasure space between that tooth and the future screw-retained crown made for that implant. The larger the angle at which the interproximal surface converges towards the imaginary axes of the path of placement of that future screw-retained crown, the larger the volume of that imaginary triangle will be, and the larger the volume of the resulting interproximal embrasure space at that interproximal contact will be.

At each vertical height point along the interproximal surface of a tooth neighboring the future screw-retained crown, there is a specific quantity of linear distance between that point and the imaginary plane (Figure 5). This specific distance, at each vertical point along the neighboring tooth interproximal surface, forms an imaginary linear distance boundary. When a laboratory technician fabricates a screw-retained crown that follows the path of placement that is defined by the cylinder-shaped intaglio surface of the implant for that crown, the technician cannot form crown interproximal surface material any closer towards the interproximal tooth surface than the distance limit formed by this boundary.

Put another way, the technician cannot form crown interproximal surface material any closer to the interproximal tooth surface than the distance formed between the interproximal surface and the imaginary plane that is both parallel to the path of placement axes of the screw-retained crown and that also intersects the occlusal-interproximal line angle of that tooth neighboring the future screw-retained crown. Such crown material would be obstructed by the interproximal surface of the neighboring tooth while the screw-retained crown was being inserted along the implant-determined path of placement. Hence, an interproximal tooth surface that converges at a "tiny angle" towards the imaginary path of placement of the future screw-retained implant will allow a technician to make a screw-retained crown that shows minimum embrasure space volume at that interproximal tooth surface.

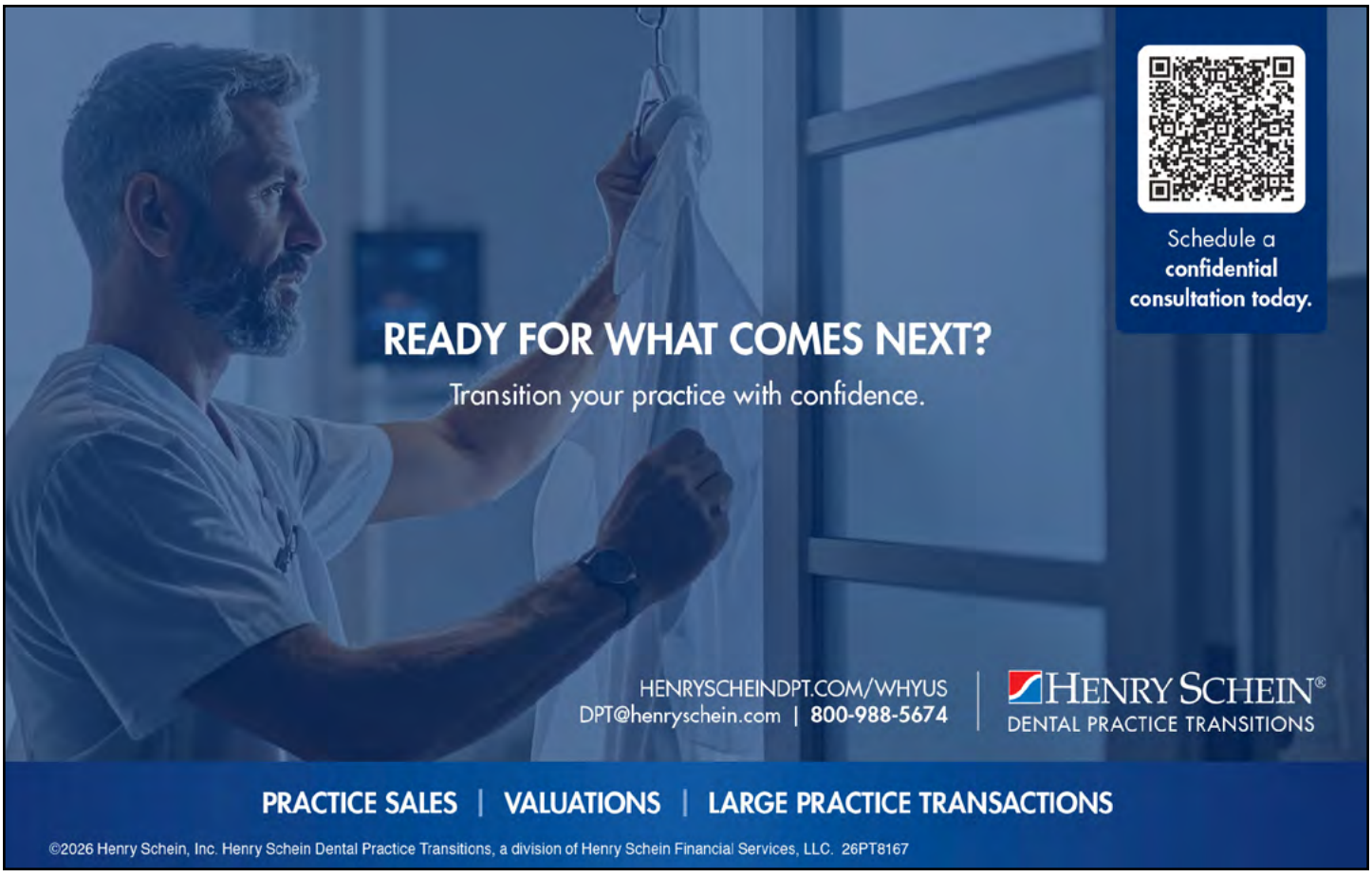
Interproximal Surface Contouring

A dentist may need to contour the interproximal surface of a neighboring tooth to reduce the angle at which the surface

converges towards the imaginary path of placement axes, from a large convergence angle to a small convergence angle. To determine how much to contour the interproximal surfaces of a tooth neighboring a future screw-retained implant crown, a dentist must identify a visual axis that allows the dentist to see the entire intaglio surface of the implant. This visual axis will then be parallel with the set of imaginary parallel axes that form the cylinder-shaped path of placement of the future screw-retained restoration. Typically, the dentist must identify such a parallel visual axis while observing the implant intaglio surface indirectly through an intraoral mirror. The dentist must then precisely move the mirror such that the visual axes provided by the mirror remain parallel with the set of imaginary axes that form the implant intaglio surface cylinder shape, until the dentist can observe an interproximal tooth surface with the mirror.

If the dentist can observe the superior aspect of the neighboring tooth interproximal surface, but not the inferior aspect, while viewing that interproximal surface with a viewing axis that is parallel with the set of imaginary axes of the cylinder-shaped path of placement defined by the implant intaglio volume, then the interproximal surface is convergent with the set of imaginary parallel axes that form the path of placement of the future screw-retained restoration (Figure 6). At this position, if the dentist, by shifting the mirror by a tiny angle of perhaps 10 degrees or less, can see the inferior aspect of the interproximal surface of the neighboring tooth, then the interproximal tooth surface will be slightly convergent towards the set of imaginary parallel axes that form the path of placement of the future screw-retained restoration (Figure 7).

However, if instead, the dentist must shift the mirror at a relatively large angle of perhaps greater than 10 degrees to be able to see the inferior aspect of the neighboring tooth interproximal surface, then this interproximal surface converges with a relatively large angle towards the set of imaginary parallel axes that form the path of placement of the future screw-retained restoration. The dentist would need to trim the superior aspect of that heavily convergent neighboring tooth interproximal surface until that surface was slightly convergent with the set of imaginary parallel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axes that form the path of placement of the future screw-retained restoration. The dentist can use a thin, pointy, cone-shaped aluminum oxide polishing bur to trim the superior line angle of the interproximal contact in a direction that is distal from the implant. The dentist trims the superior line angle of the interproximal surface until only a tiny tilt of a mouth mirror visual axis, which was previously parallel with the axes of the imaginary path of placement cylinder, will permit the dentist to see both the inferior and superior line angles of that interproximal tooth surface.

If the dentist can observe both the superior and inferior line angles of the interproximal tooth surface while viewing that interproximal surface with a viewing axis that is parallel with the set of imaginary axes of the cylinder-shaped path of placement defined by the implant intaglio volume, then the surface plane will be divergent with the set of imaginary parallel axes that forms the path of placement of the future screw-retained restoration (Figure 8). It may be difficult or impossible to contour a surface to convert a divergent interproximal tooth surface angle to a convergent angle.

Extreme visual precision is needed to visualize the imaginary cylinder of the path of placement formed by the intaglio volume of the implant and to determine if a visual axis used to observe an interproximal tooth surface is exactly parallel with the set of imaginary axes that form the path of placement of the future screw-retained prosthesis. The dentist needs extreme visual precision to determine if a tooth interproximal surface converges at a tiny angle (perhaps 10 degrees or less) towards the imaginary parallel axes of the projected path of placement of the future screw-retained crown. Microscope-level magnification of 6x to 8.0x or greater, combined with shadow-free, co-axial illumination, helps a dentist verify these characteristics with microscopic precision and to verify that contouring interproximal tooth surfaces have created more optimal interproximal contact plane geometries.

Conclusion

Prior to making impressions or a scan of an implant that will receive a screw-retained fixed partial denture,[16,17] the dentist should verify that the interproximal surfaces of teeth that will neighbor the future screw-retained crown are slightly convergent in angle with the set of imaginary axes that define the implant-dictated, cylinder-shaped path of placement of that future screw-retained implant prosthesis and contour interproximal surfaces, as needed, to achieve this slightly convergent angle. This slight angular convergence of the interproximal tooth surface will allow a laboratory technician to fabricate a screw-retained prosthesis that will follow the implant-determined path of placement, such as to form an optimally shaped contact area with each neighboring tooth, which will help prevent future food impaction between the screw-retained crown and the neighboring interproximal surface(s).

Queries about this article can be sent to Dr. Mamoun at mamounjo@gmail.com.

REFERENCES

1. Mamoun JS. The path of placement of a removable partial denture: a microscope-based approach to survey and design. J Adv Prosthodont 2015;7:76–84. doi: 10.4047/jap.2015.7.1.76.
2. Mamoun J. Preparing fixed partial denture abutments such that they provide a path of placement free of undercuts. Gen Dent 2012;60:519-525.
3. Abduo J, Lau D. Proximal contact loss between implant prostheses and adjacent natural teeth: a qualitative systematic review of prevalence, influencing factors and implications. Heliyon 2022 Aug 1;8(8):e10064. doi: 10.1016/j.heliyon.2022.e10064.
4. Bompolaki D, Edmondson SA, Katancik JA. Interproximal contact loss between implant-supported restorations and adjacent natural teeth: a retrospective cross-sectional study of 83 restorations with an up-to-10-year follow-up. J Prosthet Dent 2022 Mar;127(3):418-424. doi: 10.1016/j.prosdent.2020.09.034. Epub 2020 Dec 17.
5. Cheng Y, Wang Z, Shi Y, Guo Q, Li Q, Chai R, Wu F. Research on the characteristics of food impaction with tight proximal contacts based on deep learning. Comput Math Methods Med 2021 Nov 5;2021:1000820.
6. Chopra Aditi & Sivaraman, Karthik & Narayan, Aparna & Balakrishnan, Dhanasekar. Etiology and classification of food impaction around implants and implant-retained prosthesis. Clin Implant Dent Relat Res 2019;21:391–397.
7. French D, Naito M, Linke B. Interproximal contact loss in a retrospective cross-sectional study of 4325 implants: distribution and incidence and the effect on bone loss and peri-implant soft tissue. J Prosthet Dent 2019;122:108–114.
8. Gasser TJW, Papageorgiou SN, Eliades T, Hämmerle CHF, Thoma DS. Interproximal contact loss at implant sites: a retrospective clinical study with a 10-year follow-up. Clin Oral Implants Res 2022 May;33(5):482-491. doi: 10.1111/clr.13908. Epub 2022 Mar 1.
9. Ghasemi S, Oveisi-Oskouei L, Torab A, Salehi-Pourmehr H, Babaloo A, Vahed N, Abolhasanpour N, Taghilou S, Ghasemi A. Prevalence of proximal contact loss between implant-supported fixed prosthesis and adjacent teeth and associated factors: a systematic review and meta-analysis. J Adv Periodontol Implant Dent 2022 Nov 12;14(2):119-133. doi: 10.34172/japid.2022.023.
10. Greenstein G, Carpentieri J, Cavallaro J. Open contacts adjacent to dental implant restorations: etiology, incidence, consequences, and correction. J Am Dent Assoc 2016;147:28–34.
11. Jeong JS, Chang M. Food impaction and periodontal/peri-implant tissue conditions in relation to the embrasure dimensions between implant-supported fixed dental prostheses and adjacent teeth: a cross-sectional study. J Periodontol 2015 Dec;86(12):1314-20. doi: 10.1902/jop.2015.150322. Epub 2015 Aug 13.
12. Kim JH, Yi YJ. Factors influencing proximal contact loss between fixed implant prostheses and adjacent natural teeth: a retrospective study. J Korean Assoc Oral Maxillofac Surg 2025 Feb 28;51(1):26-32. doi: 10.5125/jkaoms.2025.51.1.26.
13. Manicone PF, De Angelis P, Rella E, Papetti L, D'Addona A. Proximal contact loss in implant-supported restorations: a systematic review and meta-analysis of prevalence. J Prosthodont 2022 Mar;31(3):201-209. doi: 10.1111/jopr.13407. Epub 2021 Aug 5.
14. Wang J, Lin J, Chen Y, Wu X. Analysis of the risk of interproximal contact loss between adjacent teeth and implant-supported fixed prostheses: a retrospective cross-sectional study. J Prosthet Dent 2025; Mar 27:S0022-3913(25)00195-7. doi: 10.1016/j.prosdent.2025.02.047. Epub ahead of print. PMID: 40155260.
15. Yen J-Y, Kang L, Chou I-C, et al. Risk assessment of interproximal contact loss between implant-supported fixed prostheses and adjacent teeth: a retrospective radiographic study. J Prosthet Dent 2022;127:86–92.
16. Assaf M, Abu Gharbyeh AZ. Screw-retained crown restorations of single implants: a step-by-step clinical guide. Eur J Dent 2014;8:563-70.
17. Fiorillo L, D'Amico C, Ronsivalle V, Cicciù M, Cervino G. Single dental implant restoration: cemented or screw-retained? A systematic review of multi-factor randomized clinical trials. Prosthesis 2024;6:871–886. https://doi.org/ 10.3390/prosthesis6040063.

John S. Mamoun, D.M.D., is in private practice in Manalapan, NJ.